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FACULTY OF ARTS AND SCIENCES

DEPARTMENT OF ZOÖLOGY

1904–05

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These publications include: —

- The Annual Reports of the President and of the Treasurer.
- The Annual University Catalogue.
- The Annual Catalogues of the College and the several Professional Schools of the University; the Announcements of the several Departments; etc., etc.

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AUTHORIZED LECTURER IN ZOÖLOGY FOR 1904–05

Alexander Petrunkévitch, Ph.D.

COMMITTEE ON ZOÖLOGY

(Appointed by the Board of Overseers)

David W. Cheever, M.D., LL.D.,	557 Boylston St., Boston.
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Note. — The addresses of instructors and their consultation hours are published soon after the beginning of the academic year in the *University Directory.*

DEPARTMENT OF ZOÖLOGY

1904–05

GENERAL STATEMENT

All Zoölogical Courses are given in the Natural History Laboratories of the Museum of Comparative Zoölogy, founded by Professor Louis Agassiz in 1859. The instruction by lectures and laboratory work in Morphology, Histology, Embryology, Physiology, and Palaeozoölogy is conducted in rooms on the first, fourth, and fifth floors, and in the basement, of the northwest section of the Museum.

The courses primarily for undergraduates are given on the first floor, where a lecture room, seating about three hundred, and a large laboratory, accommodating students in sections of about forty each, are assigned to these courses.

The courses for undergraduates and graduates are conducted on the first and fourth floors. On the fourth floor are laboratories for comparative anatomy, histology, embryology, and experimental work. These laboratories are provided with appliances for the injection and preservation of anatomical material, with paraffine baths heated by electricity, microtomes, microscopes, and other apparatus necessary for zoölogical work. As a rule, the lectures in these courses are given on the fourth floor in a lecture room that is also used as a meeting place for the Zoölogical Club. On this floor are to be found the private rooms of three of the instructors. On the first floor is the palaeontological laboratory, containing an extensive collection of palaeontological material. In the basement is a vivarium that may be used for breeding experiments, two dark rooms for photographic work and light experiments, an aquarium room containing a number of large stationary fresh-water and marine aquaria, floor-tanks, and other appliances for the study of aquatic animals, and a work room for the construction and repair of apparatus.

Students who are admitted to research work, primarily for graduates, are usually assigned places in a large, well-lighted laboratory on the fifth floor, though the nature of their work may often require them to do much of it in other parts of the laboratories. A special laboratory for Radcliffe students is also on this floor. Students in the laboratories enjoy the advantage of being in the same building with the exceptionally rich library and collections of the Museum of Comparative Zoölogy.

A series of about 1600 diagrams, several cases of anatomical preparations arranged in the laboratories and adjacent halls, and an extensive collection of embryological preparations and models are used in the illustration of lectures.

The books which are most needed in connection with class instruction are in both the Museum Library and the Library of the Zoölogical Laboratories. The latter at present contains about 250 volumes, the Museum Library about 38,000 volumes, and many pamphlets, principally on Zoölogy and Palaeontology. Besides these, the zoölogical memoirs contained in the transactions of many of the learned societies are to be found in the College Library. The University Library contains in all about 400,000 bound volumes, and about an equal number of unbound pamphlets and maps. In addition, the numerous and extensive libraries of Boston are readily accessible to students. It therefore rarely happens that any one engaged on a special topic of research fails to find at his command all the literature on the subject; and in such an event the desired works are usually included in the regular orders for the increase of the Museum Library. All the available current periodicals in Zoölogy and Palaeontology are received at the Museum Library and at once made accessible on tables in reading rooms which have accommodations for about fifty students.

Information regarding the Museum of Comparative Zoölogy and the facilities offered by it will be found in the University Catalogue.

DESCRIPTION OF COURSES

According to the general plan of grouping adopted by the Faculty of Arts and Sciences the courses in Zoölogy fall into the following three groups.

In Group I are embraced elementary courses (1 and 2) intended for undergraduates only; in Group II, courses (3–16) which are open to both undergraduates and graduates; in Group III, research (20), intended for graduates. Undergraduates will not be admitted to work in research except in cases of unusual proficiency: but graduates are allowed to pursue and count toward the higher degrees any of the courses except those in Group I.

The requirements for entrance to each course are given in the detailed statement of the course. From these statements the proper sequence of courses is readily made out. The starred courses require the previous consent of the instructor. *Students intending to give special attention to Zoölogy will do well to elect Course 1 in the Freshman year and Course 2 in the Sophomore year, in order to leave sufficient time for work in more advanced courses. The only way in which Courses 1, 2, and 3 can be taken in less than three years is by electing Courses 1 and 2 in the same year, since Course 3 cannot be taken until Course 2 has been finished.* Students having Zoölogy especially in view are advised to pursue, *early in their undergraduate work, elementary courses in Physics and Chemistry, in addition to courses in Botany and Geology*, and also to give some attention to freehand drawing.

Students proposing to enter the *medical profession* are strongly advised to take as a preparation at least *Courses 1, 2, and 3.*

Ability to read German and French will be of advantage in any of the courses in Zoölogy, and will be presumed in those not primarily for undergraduates.

Foreign books should be ordered two or three months before the beginning of the course in which they are needed.

Although microscopes are provided by the University, those students whose means will allow are advised to purchase microscopes of their own. Those wishing information on the subject should consult the instructors.

DETAILED STATEMENT

I. Primarily for Undergraduates

1 ¹*hf.* Zoölogy. — Lectures and laboratory exercises. *Half-course (first half-year).* Lectures, *Tu., Th., at 10.* Laboratory exercises in one of the following sections: I, *Fri., 1.30–4.30;* II, *Sat., 9–12;* III, *Mon., 9–12;* IV, *Mon., 1.30–4.30;* V, *Tu., 9–10 and 11–1;* VI, *Tu., 1.30–4.30.* Asst. Professor G. H. Parker, Mr. L. J. Cole, and other assistants. (XI)

This course is designed to acquaint students with the general principles of Zoölogy, and is required as preparation for all other courses in Zoölogy. It includes a brief historical consideration of the science and its subdivisions, and a discussion of the characteristics of animals as represented by their structure and activities. The chief groups of the animal kingdom are outlined and a number of their common representatives described. The distribution of animals in time and space is considered. The study of the structure and functions of cells, tissues, and organs is taken up, as well as the consideration of the forms of animals. The principles governing animal development are dealt with. The relations of animals to their environment and the various theories offered to explain how the modification of animals has been effected are considered.

For collateral reading students are expected to procure R. Hertwig* (:02), Thomson ('99), or Parker and Haswell (:00). For more extended reading in connection with parts of the course the following books will be found of service: on systematic zoölogy, Leunis ('83–86); on distributional zoölogy, Beddard ('95), Wallace ('76); on morphology, Parker and Haswell ('97), Lang ('88–94), Wilson (:00). Korschelt und Heider ('90–03); on physiology, Verworn (:01), Schenck and Gürber (:00); on œcology, Semper ('81); on theories of evolution, Darwin ('80), Osborn ('94), Morgan (:03).

The laboratory exercises, which do not require dissection by the student, consist of a study of material to illustrate the topics treated of in the lectures. These exercises are supplemented by visits to the exhibition rooms of the museum and, weather permitting, by field excursions.

2 ²*hf.* Morphology of Animals. — Lectures and laboratory work. *Half-course (second half-year). Mon., Wed., Fri., at 2.30.* Asst. Professor Castle, and assistants. (VII)

This course may be taken separately from Botany 2 only with the consent of the instructor. It is most advantageously taken in the same year as Botany 2 and is open to those only who have taken Zoölogy 1 or its equivalent. Its aim is to afford in connection with Botany 2 the necessary elementary training for those who desire to pursue subsequently the study of some branch of Biology. Since Zoölogy 2 is required as a preparation for several other electives, it should be taken early in the college course; if possible, not later than the Sophomore year. It may be taken in the same year with Zoölogy 1.

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* The titles, prices, etc., of all books referred to will be found in an alphabetical list of authors on pp. 13–17.

The lectures are given on Mondays, Fridays, and occasionally on Wednesdays. They deal with the morphology and biology of the more important groups of animals, and follow immediately the dissection or microscopical examination of a selected representative of each group.

Every student is required to take six hours of laboratory work per week at some time during the eighteen hours of laboratory instruction offered on Monday, Wednesday, and Friday. An excellent guide in the dissection of many of the animals studied is Marshall and Hurst ('99).

The best books for reading in connection with the lectures are Parker and Haswell ('97) or (:00), and Lang ('88–94). The following works of reference will also be found of value: Delage et Hérouard ('96—) for the classification, anatomy, morphology, and special physiology of invertebrates; Korschelt und Heider ('90–03) for the development of invertebrates; Gaupp ('96—) for the anatomy of the frog; and Leunis ('83–86) for the classification of vertebrates and invertebrates.

II. For Undergraduates and Graduates

3 ¹*hf*. Comparative Anatomy of Vertebrates. — Lectures and laboratory work. *Half-course (first half-year). Tu., Sat., at 9.* Asst. Professor G. H. Parker and Mr. A. D. Howard. (X)

Course 3 is open to those only who have taken Courses 1 and 2.

This course is intended for those who are particularly interested in Zoölogy, and also for those who wish to lay a broad foundation for their subsequent study of human anatomy as medical students.

Lectures are given on Tuesdays and Saturdays. In the lectures special attention is given to evidences of progressive modifications in the structure of the organs as exhibited in passing from lower to higher vertebrates.

Every student is required to take six hours of laboratory work per week at some time during the sixteen hours of laboratory instruction offered on Tuesday, Thursday, and Saturday.

Students are advised to procure Wiedersheim (:02). In addition the following text-books are recommended: Gegenbaur ('98–01); Parker and Haswell ('97), vol. 2; O. Hertwig ('96); and Wiedersheim (:02^{a}). In connection with the laboratory work the following books will be found useful: Parker ('95); Marshall and Hurst ('99).

4 ¹*hf.* Microscopical Anatomy. — Lectures and laboratory work. *Half-course (first half-year). Mon., Wed., Fri., at 10.* Professor MARK and Mr. ——. (III)

Course 4 is preparatory to Courses 5 and 20. It is open to those only who have taken Course 2, and take or *have taken* Course 3. It is intended for those who wish to prepare themselves to carry on independent investigations. It presupposes an elementary knowledge of animal morphology, and some familiarity with the use of the microscope. As the number of students who can be accommodated is small, preference will be given to those preparing to take Course 5 or 20.

In this course instruction is given in methods of investigation, the animal studied being some invertebrate. There will be two, or, at the option of the instructor, three lectures a week. Every student is required to take six hours of laboratory work per week — preferably during morning hours — on two or more of the following days: Monday, Wednesday, and Friday.

Students are advised to buy Lee (: 00), and Gage (:01). The following will also be found useful: Behrens, Kossel und Schiefferdecker ('89), Carpenter (: 01), Apáthy ('96—), and Haecker ('99).

*5 ²*hf.* Embryology of Vertebrates. — Lectures and laboratory work. *Half-course (second half-year). Mon., Wed., Fri., at 10.* Professor MARK and Mr. ——. (III)

Course 5 is open to those only who have taken Course 4.

The lectures in this course deal in a comparative way with the development of vertebrates. The laboratory work consists in the preparation and study of the chick and other vertebrates at successive stages of development. The requirements regarding laboratory work are the same as for Course 4.

Students should procure Foster and Balfour ('98) and O. Hertwig (:02). In addition are recommended O. Hertwig (:01—), Marshall ('93), Minot ('93), Schultze ('97), and Kollmann ('98).

8 ²*hf.* Fossil Vertebrates. — Lectures and laboratory work. *Half-course (second half-year). Wed., Fri., at 11.* Asst. Professor R. T. JACKSON. (IV)

Course 8 is open to those students only who have taken Courses 3 and 9.

This course is intended to acquaint students with the structure of the more important types of fossil vertebrates and their relations to living forms.

9 ¹*hf*. Fossil Invertebrates. — Lectures and laboratory work. *Half-course (first half-year). Tu., Th., and (at the pleasure of the instructor) Sat., at 10.* Asst. Professor R. T. JACKSON. (XI)

Course 9 is open to those only who have taken Courses 1, 2, and Geology 5.

This course is intended to give in zoölogical sequence an acquaintance with the geological history of invertebrates. It considers the structure and development of representative fossil types and their systematic relations to one another and to recent allies. Attention is given to phylogenetic relations as expressed in the development of the individual and in systematic series. The geological occurrence of each group of animals, and their relative importance as rock-builders are considered.

Students will find Zittel (:00) a valuable aid in this course.

9*a* ²*hf*. Fossil Invertebrates. — Advanced studies of special groups. Lectures and laboratory work. *Half-course (second half-year). Tu., Th., at 10.* Asst. Professor R. T. JACKSON. (XI)

Course 9*a* is open to those only who have taken Course 9.

This course consists of laboratory work with accompanying lectures. It takes up limited groups, such as Actinozoa, Mollusca, Trilobita, etc., and treats of them critically and more in detail than is possible in a general survey of the subject, such as is aimed at in the introductory course, 9. The groups selected will vary according to the needs of students or the pleasure of the instructor.

*10 ¹*hf*. Experimental Morphology. — Lectures, laboratory work, and a thesis. *Half-course (first half-year). Tu., Th., at 3.30.* Asst. Professor CASTLE. (XVI)

Courses 10 and 11 are open to those only who have taken Course 2, and may be taken advantageously either *after* or with Course 3. They are given in alternate years and are not dependent upon each other; accordingly they may be taken in either sequence.

Course 10 is designed for those who are interested in experimental work. The lectures treat of the normal activities and structure of protoplasm and the modifications which they undergo through the action of different chemical and physical agents. Among the topics discussed are response to stimuli, and the influence on the individual of changes in environment brought to bear either on the adult or on the embryo.

The laboratory work in Courses 10 and 11 consists of the experimental study of a selected subject on which the student is to report at the end of the course.

These courses require at least such a knowledge of the structure of animals and plants as is gained in Course 2 and Botany 2, and a knowledge of microscopic technique will be found of advantage, although not necessary.

Students will find useful Davenport ('97–99), Verworn (:01), and Morgan (:01).

[*11 ¹*hf.* Variation and Heredity. — Lectures, laboratory work, and a thesis. *Half-course (first half-year). Tu., Th., at 3.30.* Asst. Professor CASTLE.] (XVI)

Omitted in 1904–05.

This course deals with the processes involved in the evolution of races and species. In the lectures, variation and heredity are discussed from the standpoint of statistics and experiment. A presentation is thus made of the scientific principles which underlie successful work in the improvement of races of domesticated animals and plants.

For a statement concerning laboratory work and the preparation required for the course, see under Course 10.

Students will find the following books useful: Bateson ('94) and (:02); Darwin ('76); Galton ('89); Delage ('95); Davenport ('99); de Vries (:01–03).

[*13 ¹*hf.* Comparative Histology, with special reference to Nervous Tissues. — Lectures and laboratory work. *Half-course (first half-year). Mon., Wed., Fri., at 3.30.* Asst. Professor G. H. PARKER.] (VIII)

Omitted in 1904–05.

This course is intended for those who wish to become acquainted with the structure and genesis of the chief animal tissues, and especially with the structure and functions of the nervous elements in their relations to other tissue elements.

Course 13 is open to those only who have taken Course 2 or its equivalent and who have taken or are taking Course 3.

The laboratory work requires at least six hours a week and must be done on the afternoons of Monday, Wednesday, and Friday.

Students are expected to procure Schneider (:02).

[*15 ²*hf.* The Structure and Functions of the Nervous System and its Relation to Animal Habits. — Sense Organs. Lectures, laboratory work, and reports. *Half-course (second half-year). Mon., Wed., Fri., at an hour to be arranged.* Asst. Professor G. H. PARKER.]

Omitted in 1904–05.

*16 ²*hf*. The Structure and Functions of the Nervous System and its Relation to Animal Habits. — Central Nervous Organs and Terminal Organs of Efferent Nerves. Lectures, laboratory work, and reports. *Half-course (second half-year). Mon., Wed., Fri., at an hour to be arranged.* Asst. Professor G. H. PARKER.

Courses 15 and 16 are designed primarily for those who intend to make a special study of the nervous system and its relation to animal habits.

These courses are given in alternate years. They are open to those only who have taken Course 3. They are independent of each other and may be taken in either sequence. In each course the student will be given a special topic for laboratory work, the results of which are to be presented at the end of the course in the form of a report.

In Course 15 Jourdan ('89) and Lubbock ('88) will be found serviceable.

In Course 16 either Edinger (:00) or Loeb ('99) are required, and Ramon y Cajal ('94), Barker ('99), Van Gehuchten (:00), Donaldson ('95), and Romanes ('93) will be found serviceable.

III. Primarily for Graduates

20. Zoölogical Investigations. Professor MARK, Asst. Professors R. T. JACKSON, G. H. PARKER, and CASTLE.

This course is designed for those only who are competent, with the aid of the instructor, to carry on some original investigation. Each student selects, with the advice of the instructor, the subject of his research, and the results are embodied in a thesis. The investigations of advanced students, when considered worthy of publication, usually appear in the Contributions from the Zoölogical Laboratory.

Persons contemplating this work will find it to their advantage to consult the Director of the Laboratory at an early date, — if possible, as early as the first of April of the academic year preceding that in which the work is to be done.

INSTRUCTION BY DOCTORS OF PHILOSOPHY.

By a vote of the President and Fellows, passed January 11, 1897, the Faculty is empowered to authorize any Doctor of Philosophy or of Science who shall be approved by the Department with which his work is most closely related, to give instruction for a period not exceeding four months either gratuitously or for such fees as he may himself fix and collect.

Under this vote the following course has been authorized for 1904–05.

Cytology. (*Second half-year.*) Dr. ALEXANDER PETRUNKÉVITCH.

LIST OF BOOKS REFERRED TO IN THE ACCOUNT OF THE COURSES IN ZOÖLOGY.

Apáthy, S.
'96-. Die Mikrotechnik der thierischen Morphologie. Abth. 1, u. 2, 1te Hälfte. (H. Bruhn, Braunschweig, Mk. 14.60, *unfinished.*)

Barker, L. F.
'99. The Nervous System and its Constituent Neurones. (D. Appleton & Co., New York, $6.00.)

Bateson, W.
'94. Materials for the Study of Variation. (The Macmillan Co., New York, $6.50.)

Bateson, W.
:02. Mendel's Principles of Heredity. (The University Press, Cambridge, Eng., $1.30.)

Beddard, F. E.
'95. A Text-book of Zoögeography. Cambridge Natural Science Manuals. (The University Press, Cambridge, Eng., 6s.)

Behrens, Kossel und Schiefferdecker.
'89. Das Mikroskop, Bd. I. (H. Bruhn, Braunschweig, Mk. 9.80, bound.)

Carpenter, W. B.
:01. The Microscope, etc., 8th ed., by **Dallinger.** (P. Blakiston's Son & Co., Phila., $8.00.)

Darwin, C.
'76. The Variation of Animals and Plants under Domestication, 2d ed., 2 vols. (D. Appleton & Co., New York, $5.00.)

Darwin, C.
'80. Origin of Species, 6th ed. (D. Appleton & Co., New York, $2.00, *or* 2 vols., large print, $4.00.)

Davenport, C. B.
'97–99. Experimental Morphology. Effect of Chemical and Physical Agents upon Protoplasm (Part I); Upon Growth (Part II). (The Macmillan Co., New York, $4.60.)

Davenport, C. B.

'99. Statistical Methods with Special Reference to Biological Variation. (John Wiley and Sons, New York, $1.25.)

Delage, Y.

'95. La structure du protoplasm et les théoriés sur l'hérédité et les grands problèmes de la biologie générale. (C. Reinwald et Cie., Paris, $7.00.)

Delage, Y., et Hérouard, E.

'96—. Traité de Zoologie concrète, tom. 1, 2, 3, 5, 8. (Schleicher Frères, Paris, frcs. 25 each, *unfinished.*)

Donaldson, H. H.

'95. The Growth of the Brain. (Contemp. Sci. Ser., Charles Scribner's Sons, New York, $1.25.)

Edinger, L.

:00. Vorlesungen über den Bau der nervösen Centralorgane, 6te Aufl. (Vogel, Leipzig, Mk. 12), *or* transl. of 5te Aufl. by **W. S. Hall:** The Anatomy of the Central Nervous System of Man and of Vertebrates in General. (F. A. Davis, Phila., $3.00.)

Foster, M., and Balfour, F. M.

'98. The Elements of Embryology, 2d ed. (Macmillan & Co., New York, $2.60.)

Gage, S. H.

:01. The Microscope and Microscopical Methods, 8th ed. (Comstock Pub. Co., Ithaca, N.Y., $1.50.)

Galton, F.

'89. Natural Inheritance. (Macmillan & Co., New York, $2.00.)

Gaupp, E.

'96—. A. Ecker und R. Wiedersheim's Anatomie des Frosches, Abth. 1, 2, u. 3, 1te Hälfte. (Vieweg u. Sohn, Braunschweig, Mk. 52, *unfinished.*)

Gegenbaur, C.

'98–01. Vergleichende Anatomie der Wirbelthiere mit Berücksichtigung der Wirbellosen. 2 Bde. (W. Engelmann, Leipzig, Bd. I, Mk. 28; Bd. II, Mk. 20.)

Haecker, V.

'99. Praxis und Theorie der Zellen- und Befruchtungslehre. (Fischer, Jena, Mk. 8, bound.)

Hertwig, O.

:01—. Handbuch der vergleichenden und experimentellen Entwickelungslehre der Wirbeltiere. (Fischer, Jena, Bd. I, Lief. 1–17, Mk. 4.50 per Lief., *unfinished.*)

Hertwig, O.

:02. Lehrbuch der Entwicklungsgeschichte des Menschen und der Wirbelthiere, 7te Aufl. (Fischer, Jena, Mk. 15, bound), *or* English transl. of 3te Aufl. by **E. L. Mark:** Text-book of the Embryology of Man and Mammals. (Swan, Sonnenschein & Co., London; Macmillan & Co., New York, 1892, $5.25.)

Hertwig, R.

:02. A Manual of Zoölogy. English transl. from 5th German ed. by **J. S. Kingsley.** (Henry Holt & Co., New York, $3.00.)

Jourdan, E.

'89. Les sens chez les animaux inférieurs (J. B. Ballière et fils, Paris, frcs. 3.50, *also* Biblioth. sci. contemp. 1890), *or* German transl. by **W. Marshall:** Die Sinne und Sinnesorgane der niederen Tiere. (J. J. Weber, Leipzig, 1891, Mk. 4.)

Kollmann, J.

'98. Lehrbuch der Entwickelungsgeschichte des Menschen. (Fischer, Jena, Mk. 17, bound.)

Korschelt, E., und Heider, K.

'90–03. Lehrbuch der vergl. Entwicklungsgeschichte der wirbellosen Thiere, Hefte 1–3. Allgemeiner Theil, Lief. 1, 2. (Fischer, Jena, Mk. 54.50), *or* English transl. of Heft 1, by **E. L. Mark and W. McM. Woodworth:** Text-book of the Embryology of Invertebrates, Pt. I. (Macmillan & Co., New York, 1895, $4.00); of Hefte 2, 3, by **M. Bernard,** Pts. II, III, and IV. (The Macmillan Co., New York, 1899–1900, $10.75.)

Lang, A.

'88–94. Lehrbuch der vergleichenden Anatomie der wirbellosen Thiere (Fischer, Jena, Mk. 24), *or* English transl. by **H. and M. Bernard:** Text-book of Comparative Anatomy. (Macmillan & Co., New York, 1891, 1896, $11.00.)

Lee, A. B.

:00. The Microtomist's Vade Mecum, 5th ed. (Churchill, London, $4.00. P. Blakiston's Son & Co., Philadelphia.)

Leunis, J.

'83–86. Synopsis der Thierkunde, 3te Aufl. von **H. Ludwig,** 2 Bde. (Hahn, Hanover, Mk. 34.)

Loeb, J.

'99. Einleitung in die vergleichende Gehirnphysiologie und vergleichende Psychologie mit besonderer Berücksichtigung der wirbellosen Thiere (J. A. Barsch, Leipzig, Mk. 6), or English transl. (G. P. Putnam's Sons, New York, 1900, $1.75.)

Lubbock, J.
'88. On the Senses, Instincts, and Intelligence of Animals. (Internat. Sci. Ser., D. Appleton & Co., New York, $1.75.)

Marshall, A. M.
'93. Vertebrate Embryology. (Smith, Elder & Co., London, 21s.)

Marshall, A. M., and Hurst, C. H.
'99. A Junior Course of Practical Zoölogy, 5th ed. (G. P. Putnam's Sons, New York, $3.50.)

Minot, C. S.
'93. Human Embryology. (Wm. Wood & Co., New York, $6.00.)

Morgan, T. H.
:01. Regeneration. (The Macmillan Co., New York, $3.00.)

Morgan, T. H.
:03. Evolution and Adaptation. (The Macmillan Co., New York, $3.00.)

Osborn, H. F.
'94. From the Greeks to Darwin. An Outline of the Development of the Evolution Idea. (The Macmillan Company, New York, $2.00.)

Parker, T. J.
'95. A Course of Instruction in Zoötomy (Vertebrata). (The Macmillan Co., New York, $1.25.)

Parker, T. J., and Haswell, W. A.
'97. A Text-Book of Zoölogy, 2 vols. (The Macmillan Co., New York, $9.00.)

Parker, T. J., and Haswell, W. A.
:00. A Manual of Zoölogy. (The Macmillan Co., New York, $1.60.)

Ramon y Cajal, S.
'94. Les nouvelles idées sur la structure du système nerveux chez l'homme et chez les vertébrés. (C. Reinwald & Cie., Paris, frcs. 3.)

Romanes, G. J.
'93. Jelly-fish, Star-fish, and Sea-urchins, being a Research on Primitive Nervous Systems. (Internat. Sci. Ser., D. Appleton & Co., New York, $1.75.)

Schenck, F., and Gürber, A.
:00. Outlines of Human Physiology. English transl. from 2d German ed. by **W. D. Zoethout.** (Henry Holt & Co., New York, $1.75.)

Schneider, C.
:02. Lehrbuch der vergleichenden Histologie der Tiere. (Fischer, Jena. Mk. 24.)

Schultze, O.
'97. Grundriss der Entwicklungsgeschichte des Menschen und der Säugethiere. (W. Engelmann, Leipzig, Mk. 13, bound.)

Semper, C.
'81. Animal Life as Affected by the Natural Conditions of Existence. (Internat. Sci. Ser., D. Appleton & Co., $2.00.)

Thomson, J. A.
'99. Outlines of Zoölogy, 3d ed. (D. Appleton & Co., New York, $3.50.)

Van Gehuchten, A.
:00. Anatomie du système nerveux de l'homme. (A. Uystpruyst, Louvain, 30 Frs.)

Verworn, M.
:01. Allgemeine Physiologie. 3te Aufl. (Fischer, Jena, Mk. 15), *or* English transl. by **F. S. Lee**: General Physiology. 2d ed. (The Macmillan Co., New York, 1899, $4.00.)

Vries, H. de.
:01–03. Die Mutationstheorie. Versuche und Beobachtungen über die Entstehung der Arten im Pflanzenreich. 2 Bde. (Mk. 40). (Veit & Co., Leipzig.)

Wallace, A. R.
'76. The Geographical Distribution of Animals. (Harper & Bros., New York, $10.00.)

Wiedersheim, R.
:02. Grundriss der vergl. Anatomie der Wirbelthiere, 5te Aufl. (Fischer, Jena, Mk. 18, bound), *or* English transl. of 3te Aufl. by **W. N. Parker.** (The Macmillan Co., New York, 1897, $3.25.)

Wiedersheim, R.
:02^a. Der Bau des Menschen als Zeugnis für seine Vergangenheit, 3te Aufl. (H. Laupp'sche Buchhandlung, Tübingen, Mk. 6.60, bound), *or* English transl. of 2te Aufl. by **H. and M. Bernard**: The Structure of Man, an Index to his Past History. (Macmillan & Co., New York, 1895, $2.60.)

Wilson, E. B.
:00. The Cell in Development and Inheritance, 2d ed. (The Macmillan Co., New York, $3.50.)

Zittel, K. A.
:00. Text-book of Palaeontology. Translated and edited by **C. R. Eastman.** (The Macmillan Co., New York, $6.00.)

THE ZOÖLOGICAL CLUB

The instructors and advanced students in Zoölogy hold weekly meetings for the presentation and discussion of original work and the review of current zoölogical literature.

DEGREES

By the statutes of the University, *at least one year of residence*, devoted to studies approved by the Faculty, or under its authority, is required of a candidate for any degree.

For fuller statements of the conditions attached to the several degrees, the student is referred to the pamphlet on "College Studies" and to the Announcement of the Graduate School. The following information is intended especially for students who come from other colleges. Graduates of other colleges and students of the higher classes of other colleges are admitted to advanced standing in Harvard College, without examination, on presenting testimonials of scholarship and character, and satisfactory evidence of work well performed in the institutions previously attended. Graduates of other colleges may become candidates for the degree of A.B. on such terms as may be deemed equitable in each case by the Committee on Admission from Other Colleges; and for this purpose they must register in the undergraduate department (Harvard College).

In order to be recommended for the degree of S.B. a student must have fulfilled the requirements for that degree in one of the programmes of study organized in the Lawrence Scientific School and described in the University Catalogue for 1903–04, pages 487 ff.

In accordance with the requirements of the committee in charge of students in General Science in the Lawrence Scientific School, the following courses are prescribed for those who specialize under the Division of Biology: Zoölogy 1 and 2, Botany 1 and 2, and two other courses either in Zoölogy or in Botany or partly in each.

In order to be recommended for the degree of Master of Arts, Master of Science, Doctor of Philosophy, or Doctor of Science, a student must be a graduate of a college or scientific school of good standing, and must have been registered in the Graduate School as a resident student at least one academic year. In special cases this requirement of registration may be waived for students registered in certain other departments of the University. Applications for admission to candidacy should in all cases be addressed to the *Dean of the Graduate School.*

The ordinary requirement for the degree of Master of Arts for a graduate of a college of good standing consists of *at least one year of residence and study devoted to advanced work approved by the Administrative Board of the Graduate School as affording suitable preparation for the degree and completed with high credit.* Other persons will be admitted to the degree on conditions to be determined in each case.

The programme of study for the degree of Master of Arts must form a consistent plan of work pursued with some definite aim, though it need not lie wholly in one Department or field. This work may be done either in, or in connection with, the regular courses of instruction, or independently of them. The programme is ordinarily committed to the proper Division Committee on Honors and Higher Degrees for its consideration and approval.

The requirement for the degree of S.M. in Biology for a Bachelor of Science of Harvard University, or for a Bachelor of Arts of Harvard University whose studies for his degree would have qualified him for the degree of Bachelor of Science, or for any other student who has been accepted, without special conditions, as qualified for candidacy for the degree on the ground of his previous studies, is *a full year of residence and study in the Graduate School, devoted to advanced work in science approved by the Division of Biology as affording suitable preparation for the degree and completed with high credit.* In every case the candidate must have satisfied the Division that he is qualified by his previous training to enter on the proposed course of study, which must form a consistent plan, with a definite aim in view, and while not necessarily lying wholly within one department or field, must be of such character that it can properly be referred to the Division of Biology.

For the degree of Ph.D. in Biology not less than *two years*, — at least *one* of which must be spent in *residence at this University*, — devoted to advanced studies, approved as affording suitable preparation for the degree by the Committee on Honors and Higher Degrees in Biology, are required of students already qualified for candidacy.

for the degree. The Faculty will, in estimating the amount of a candidate's study for the degree, give weight to advanced work done in the graduate department of another university.

For the degree of S.D. in Biology, *three years of study*, approved as affording suitable preparation for the degree by the Committee on Honors and Higher Degrees in Biology, — at least *one* of these years being spent in *residence at this University*, — are required of students already qualified for candidacy for the degree. A student who holds the two degrees of Bachelor of Arts and Bachelor of Science from Harvard University is excused from one of the three years of study required for the degree of Doctor of Science.

The degree of Ph.D. or that of S.D. is given, not for the mere reason of faithful study for a prescribed time or in fulfilment of a determinate programme, and never for miscellaneous studies, but on the ground of long study and high attainment in a special branch of learning, manifested not only by examinations, but by a thesis, which must be presented and accepted before the candidate is admitted to final examination, and must show an original treatment of a fitting subject, or give evidence of independent research.

The attention of persons intending to become candidates in Zoölogy for the degrees of Ph.D. or S.D. is called to the following **Regulations of the Committee on Honors and Higher Degrees in the Division of Biology** under which these degrees are administered.

Announcement of Candidacy. — The applicant must announce in writing to the Chairman of the Division Committee his intention of being a candidate for Ph.D. or S.D. as soon as possible after the opening of the academic year and not later than October 10 of the academic year *preceding* that in which he proposes to present his thesis. Exceptions will be made only in cases where, by special permission, a candidate is allowed to present himself for the doctor's degree on one year of residence. This announcement must be accompanied by a statement of his qualifications, of his *plan of study*, and of the field (for Ph.D.) or fields (two, for S.D.) in which he proposes to present himself for examination.

He will soon thereafter receive from the Chairman of the Committee a statement of the requirements in collateral subjects imposed upon him by the Committee, in accordance with the general requirements stated below, which he must meet not later than June of the year preceding that in which he expects to take his final examination. He will at the same time receive such comment on his plan of study as the Committee deem necessary.

General Requirements. — The attention of candidates is called to the "Conditions of Candidacy," and "Degrees of Doctor of Philosophy and Doctor of Science," published under "Degrees in Arts, Science, and Philosophy," in the University Catalogue.

Requirements in Collateral Subjects. — Every candidate is assumed to have acquired the ability to write good English and to be able to make effective use of the French and German languages in his studies. Where deficiencies in these respects exist, they must be made good at the earliest possible moment; for, until made good, the probable date at which the attainment of the degree of Ph.D. or S.D. may be expected must remain very uncertain. A reading knowledge of simple Latin prose is recommended.

The collateral requirements are: —

1. *Of all Candidates:*
    Descriptive and Experimental Physics.
    Descriptive and Experimental Chemistry.
    General Geology, including Field Work.
2. *Of Candidates in Botany:* Zoölogy.
3. *Of Candidates in Zoölogy:* Botany.

The following courses offered in Harvard University indicate the nature and extent of the requirements in these subjects: —

1. Physics 1, or Physics *C*: Chemistry 1; Geology 4 and 5.
2. Zoölogy 1 and 2.
3. Botany 1 and 2.

The candidate must pass *with distinction* (Grade *A* or *B*) in these courses, or satisfy the instructors responsible for them that he has had equivalent training.

Every candidate will at the outset of his candidacy consult with the instructor under whom he proposes to carry on his research in regard to such further preparation as the latter may advise in addition to the minimum requirement in collateral subjects above stated.

Final Year's Work. — No part of the work of a candidate during his final year shall be devoted to meeting collateral requirements.

Examinations. — All persons who present themselves as candidates in Biology for the Doctorates of Philosophy or Science will be subject to a preliminary and a final examination.

Every candidate will be required to present himself for his preliminary examination (which will cover the general field of Biology) not later than June 5th of the academic year preceding that in which he proposes to present his thesis. Exceptions will be made only in cases where, by special permission, a candidate is allowed to present himself for the doctor's degree on one year of residence. The thesis must be presented to the Chairman of the Division on or before May 1st. The final examination, which will cover the special field or fields in Botany or Zoölogy in which he presents himself, will take place after the thesis has been presented and approved; and no candidate will be admitted to this examination until he has passed the preliminary examination.

Candidates for these degrees should have acquired a satisfactory knowledge of the several fields of Zoölogy outside the special field in which their thesis work is to be carried on. The instructor under whom the research work is to be done must be consulted in regard to deficiencies of this nature, the extent of which will be finally determined by the Department of Zoölogy. The removal of such deficiencies must be provided for in the *plan of study* submitted to the Division in accordance with the provision above specified under "Announcement of Candidacy."

FELLOWSHIPS AND SCHOLARSHIPS

About $40,000 is distributed annually among undergraduate students, in amounts ranging from $40 to $450. About twenty-five fellowships and about fifty-three scholarships are also annually assigned to Graduate Students, the former varying in amount from $300 to $1,000, the latter from $150 to $400. Many of these appointments may be given or promised to persons not already members of the University. Some of the Fellowships permit the holders to study either at Harvard University or elsewhere; others require residence in Cambridge. Non-resident appointments are awarded only to persons who have been resident students in some department of the University.

The income of the Virginia Barret Gibbs Scholarship, of the value of $250, is assigned by the Faculty of the Museum of Comparative

Zoölogy, with the advice of the Professors of Zoölogy and of Comparative Anatomy of Harvard University, to one or more students who intend to give special attention to the study of Marine Zoölogy.

Students who propose to enter the Graduate School from other colleges, and are in need of aid, should apply to the Secretary of the Faculty of Arts and Sciences for blank forms of application for aid. Applications should be in the hands of the committee in charge *before the fifteenth of March.*

BOWDOIN PRIZES

are offered annually as follows: —

I. For Undergraduates

Three prizes, a first prize of *two hundred and fifty dollars*, and two second prizes of *one hundred dollars* each, for essays written by undergraduates of Harvard College or the Lawrence Scientific School in regular standing. Essays may be offered on any subject approved by the Chairman of the Committee on Bowdoin Prizes, as a proper subject for treatment in literary form. Theses that form part of the regular work in an elective course may be offered in competition, with the consent of the instructor in the course, or, subject to such consent, may be rewritten for the prize competition. The literary quality as well as the substance of the essays is taken into account in making the award. The prize winners for the year are named as such on the Commencement Programme; and the prize essays are read in public by their authors before Commencement Day. No essay may contain more than ten thousand words. Essays must be handed to the Secretary of the Faculty of Arts and Sciences, not later than April 1, and must conform to the rules printed on pages 515 and 516 of the University Catalogue for 1903–04.

II. For Graduates

Three prizes of *two hundred dollars* each will be offered annually to Graduate Students for essays of high literary merit belonging to a special field of learning. Any holder of an academic degree in Arts, Literature, Philosophy, or Science, who has been in residence in the Graduate School for one full year, within a period beginning not more than two years before the time when the prize is to be awarded, may compete for these prizes.

For the administration of the Bowdoin Prizes for Graduates, the various fields of learning from which the topics may be drawn are arranged in six groups, as follows: —

I. Mathematics, Physics, Chemistry, Engineering;
II. Biology, Geology, and Anthropology;
III. Ancient Languages and Literature;
IV. Modern Languages and Literature;
V. History and Political Science;
VI. Philosophy, Education, and the Fine Arts.

For the year 1904–05 a prize will be offered in each one of the groups numbered I, II, and III. In the year 1905–06 a prize will be offered in each one of the groups numbered IV, V, and VI. Thereafter the prizes will alternate between the two sets of groups thus defined. Not more than one prize is offered in any year for essays belonging to a single group.

Competitors are at liberty to select the topics of their essays; but the topics must be approved in advance by the Committee on Bowdoin Prizes. Each essay offered in competition must be approved, before submission to the judges, as worthy of consideration by the Committee on Honors and Higher Degrees of the Division within whose province its subject lies. Essays presented for other prizes, or for academic recognition elsewhere than in Harvard University are not admissible. The literary quality as well as the substance of the essays submitted is taken into account in making the award. The winner of the graduate prize for the year is named as such on the Commencement Programme, and the prize essay or selections from it are read in public by the author before Commencement Day.

Essays must be handed to the Secretary of the Faculty of Arts and Sciences not later than April 1, and must conform to the rules printed on page 516 and 517 of the University Catalogue for 1903–04.

All inquiries concerning the prizes should be addressed to the Chairman of the Standing Committee on Bowdoin Prizes.

EXPENSES

The tuition fee is $150. The laboratory fees in Zoölogical courses are $10.00 for each full course, $5.00 for each half-course.

A graduation fee of twenty dollars is charged to all students taking the degree of Ph.D., S.D., A.M., S.M., M.E., or Met.E.; to all students taking the degree of A.B. who have incurred fewer than four years' full tuition fees as members of the College; and to all students taking the degree of S.B. who have incurred fewer than four years' full tuition fees as members of the Scientific School. In the application of this rule, no student will be considered a member of more than one department at the same time.

The price of College rooms, for one or two persons, ranges from $30 to $350 a year. The cost of board at Memorial Hall usually does not exceed $4.25 a week; and at Randall Hall simple articles of food are furnished to order at cost, making it possible to board for from $2.50 to $3 a week.

The Harvard Coöperative Society is an organization of students and officers of the University established in 1882 for the purpose of procuring supplies for its members at a slight advance on wholesale prices. The Society keeps in stock ordinary supplies, such as books, paper, furnishing goods, etc., and fills orders for wood and coal. Through a list of affiliated tradesmen in Boston and Cambridge, the Society secures to its members discounts of from 5 to 20 per cent. from regular prices.

CONTRIBUTIONS FROM THE ZOÖLOGICAL LABORATORY

(for the current and the preceding academic years).

135. Strong, R. M. — The Development of Color in the Definitive Feather. Bull. Mus. Comp. Zoöl. Vol. 40, No. 3, pp. 145–185. 9 pls. October, 1902.

136. Castle, W. E. — Mendel's Law of Heredity. Proceed. Amer. Acad. Arts and Sciences. Vol. 38, No. 18, pp. 533–548. January, 1903.

137. Castle, W. E. — The Heredity of Sex. Bull. Mus. Comp. Zoöl. Vol. 40, No. 4, pp. 187–218. January, 1903.

138. Parker, G. H. — The Optic Chiasma in Teleosts and its Bearing on the Asymmetry of the Heterosomata (Flat Fishes). Bull. Mus. Comp. Zoöl. Vol. 40, No. 5, pp. 219–242. 1 pl. January, 1903.

139. Mark, E. L. — A Paraffine Bath heated by Electricity. Amer. Naturalist. Vol. 37, No. 434, pp. 115–119. 3 figs. February, 1903.

140. Adams, G. P. — On the Negative and Positive Phototropism of the Earthworm Allolobophora foetida (Sav.) as determined by Light of different Intensities. Amer. Jour. of Physiol. Vol. 9, No. 1, pp. 26–34. 2 figs. March, 1903.

141. Prentiss, C. W. — Polydactylism in Man and the Domestic Animals, with especial Reference to Digital Variations in Swine. Bull. Mus. Comp. Zoöl. Vol. 40, No. 6, pp. 243–314. 22 pls. and 26 figs. April, 1903.

142. Castle, W. E., and Allen, G. M. — The Heredity of Albinism. Proceed. Amer. Acad. Arts and Sciences. Vol. 38, No. 21, pp. 601–622. April, 1903.

143. Parker, G. H. — The Skin and the Eyes as Receptive Organs in the Reactions of Frogs to Light. Amer. Jour. of Physiol. Vol. 10, No. 1, pp. 28–36. September, 1903.

144. Howard, A. D. — On the Structure of the Outer Segments of the Rods in the Retina of Vertebrates. Amer. Naturalist. Vol. 37, No. 440, pp. 541–550. September, 1903.

145. Breed, R. S. — The Changes which occur in the Muscles of a Beetle, Thymalus marginicollis Chevr., during Metamorphosis. Bull. Mus. Comp. Zoöl. Vol. 40, No. 7, pp. 315–382. 7 pls. October, 1903.

146. Castle, W. E. — The Laws of Heredity of Galton and Mendel, and Some Laws Governing Race Improvement by Selection. Proceed. Amer. Acad. Arts and Sciences. Vol. 39, No. 8, pp. 221–242. November, 1903.

147. Carlton, F. C. — The Color Changes in the Skin of the so-called Florida Chameleon, Anolis carolinensis Cuv. Proceed. Amer. Acad. Arts and Sciences. Vol. 39, No. 10, pp. 257–276. 1 pl. December, 1903.

148. Lander, C. H. — The Anatomy of Hemiurus crenatus (Rud.) Lühe, an Appendiculate Trematode. Bull. Mus. Comp. Zoöl. Vol. 45, No. 1, pp. 1–28. 4 pls. January, 1904.

149. Peters, A. W. — Metabolism and Division in Protozoa. Proceed. Amer. Acad. Arts and Sciences. Vol. 39, No. 20, pp. 439–516. April, 1904.

150. Hall, R. W. — The Development of the Mesonephros and the Müllerian Duct in the Amphibia. Bull. Mus. Comp. Zoöl. Vol. 45, No. 2, pp. 29–125. 8 pls. June, 1904.

151. Bigelow, H. B. — The Sense of Hearing in the Goldfish Carassius auratus L. Amer. Naturalist. Vol. 38, No. 448, pp. 275–284. April [June], 1904.

152. Allen, G. M. — The Heredity of Coat Color in Mice. Proceed. Amer. Acad. Arts and Sciences. Vol. 40, No. 2, pp. 59–163. July, 1904.

153. Sargent, P. E. — The Optic Reflex Apparatus of Vertebrates for Short-circuit Transmission of Motor Reflexes through Reissner's Fibre; its Morphology, Ontogeny, Phylogeny, and Function: Part I. The Fish-like Vertebrates. Bull. Mus. Comp. Zoöl. Vol. 45, No. 3, pp. 127–259. 11 pls. July, 1904.

IN PREPARATION

Crawley, H. — Histological Changes occurring in the Intestinal Cells of the Newt during the Absorption of Fat.

Tower, W. L. — The Colorado Potato Beetle, Leptinotarsa (Doryphora) decem-lineata Say. A Study in Distribution and Variation.

Woodworth, C. W. — The Wing Veins of Insects.

Smallwood, W. M. — The Maturation, Fertilization, and Early Cleavage of Bulla solitaria.

Rand, H. W. — The Behavior of the Epidermis of the Earthworm in Regeneration.

Carpenter, F. W. — The Development of the Oculomotor Nerve, the Ciliary Ganglion, and the Abducent Nerve in the Chick.

Smith, G. — On the Eyes of certain Pulmonate Gastropods, with special Reference to the Neurofibrillae in Limax maximus.

⁂ Pamphlets giving information about the University or any of its Departments may be had upon application to the Secretary of the Faculty of Arts and Sciences, 5 University Hall, Cambridge, Mass., and a list of the publications of the Museum upon application to the Librarian of the Museum of Comparative Zoölogy, Cambridge, Mass.

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